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The Templeton Crocker Expedition. IX. Holothurians from the Gulf of California, the West Coast of Lower California and Clarion Island.¹

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(Text-figures 1-3).

[Note: This is the ninth of a series of papers dealing with the specimens collected on the Twenty-fourth or Templeton Crocker Expedition of the Department of Tropical Research of the New York Zoological Society; William Beebe, Director. For data on dredges, localities, dates, etc., concerning the capture of specimens treated in this paper, refer to the present volume of *Zoologica*, No. 2, pp. 33 to 46.]

CONTENTS.

| | Page |
|--|------|
| INTRODUCTION | 162 |
| ORDER ASPIDOCHIROTA | |
| Family Stichopodidae | |
| Genus <i>Parastichopus</i> Clark | |
| <i>Parastichopus californicus</i> (Stimpson) | 163 |
| Genus <i>Stichopus</i> Brandt | |
| <i>Stichopus fuscus</i> Ludwig | 163 |
| Family Holothuriidae | |
| Genus <i>Holothuria</i> Linnaeus | |
| <i>Holothuria difficilis</i> Semper | 164 |
| <i>Holothuria inhabilis</i> Selenka | 164 |
| <i>Holothuria lubrica</i> Selenka | 165 |
| <i>Holothuria paraprinceps</i> sp. nov. | 166 |
| <i>Holothuria pluricuriosa</i> sp. nov. | 166 |
| <i>Holothuria zaca</i> sp. nov. | 168 |
| ORDER DENDROCHIROTA | |
| Family Cucumariidae | |
| Genus <i>Cucumaria</i> Blainville | |
| <i>Cucumaria piperata</i> (Stimpson) | 169 |
| <i>Cucumaria lissoplaca</i> Clark | 169 |
| <i>Cucumaria populifera</i> (Stimpson) | 170 |

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| | |
|--|------|
| Genus <i>Thyone</i> Oken | Page |
| <i>Thyone benti</i> sp. nov..... | 170 |
| Family Psolidae | |
| Genus <i>Thyonepsolus</i> Clark | |
| <i>Thyonepsolus beebei</i> sp. nov..... | 172 |
| ORDER MOLPADONIA | |
| Family Molpadiidae | |
| Genus <i>Molpadia</i> Cuvier | |
| <i>Molpadia intermedia</i> (Ludwig)..... | 174 |
| BIBLIOGRAPHY | 175 |

INTRODUCTION.

Although this collection of holothurians, collected around Lower California by the Templeton Crocker Expedition in 1936, comprises only 14 species, it represents nevertheless an important addition to our knowledge of these animals and their geographic distribution. Four new species are described from the tropical region and one from the more boreal waters off the west coast of Lower California; six species have had their area distribution extended from, respectively, Hawaii, Clipperton Island and Southern California, and only three were already known from the region explored.

Although some collecting of holothurians has been done at various times at various localities in Mexico, Lower California and Central America, very little has been known about their occurrence and generally speaking the holothurian fauna has always been considered poor. The reason for the meagre results of earlier collectors has undoubtedly been due to the somewhat peculiar ecological conditions which prevail in this region, namely, an exposed coast, frequently composed of either lava rocks, sand or mud flats, habitats which are well suited for only a few species. The dredgings of the *Zaca* reveal what one may have guessed—that a comparatively rich holothurian fauna exists in somewhat deeper water. More intensive dredgings at 20 to 150 fathoms' depth will probably double or triple the number of species already known and present valuable contributions to the study of the relationship of the holothurian fauna to those of the West Indian region and the western Pacific.

I beg the Director of the Expedition, Dr. William Beebe, to accept my sincere thanks for permitting me to study this interesting material.

The entire collection is deposited in the Museum of Comparative Zoology, Cambridge, Massachusetts.

ORDER ASPIDOCIROTA.

Family Stichopodidae.

Genus *Parastichopus* Clark, 1922.

Parastichopus Clark, 1922, p. 47 (proposed in the text for the forms of *Stichopus* which are related to *S. tremulus*, *S. nigripunctatus*, etc.).

Diagnosis: Synallactid-like forms with cylindrical body. Mouth ventrally placed with broad tentacles, anus terminal. Dorsal side with large conical papillae and smaller feet; ventral side with cylindrical tube-feet more or less distinctly arranged in bands. Spicules, tables and either buttons or rods.

Type Species: *P. tremulus* (Gunnerus).

Remarks: There is no doubt that the two species known from the coast of California, *S. californicus* and *S. parvimensis*, should be removed from the typical tropical forms and it is proposed to extend the genus *Para-*

stichopus to include also these forms which are rather synallactid-like, particularly in their younger stages.

***Parastichopus californicus* (Stimpson).**

Holothuria californicus Stimpson, 1857, p. 524 (84 in reprint).

Stichopus californicus, Clark, 1922, p. 70, pl. 1, figs. 8-12.

Stichopus johnsoni Théel, 1886, p. 4; Clark, 1922, p. 69, pl. 1, figs. 15-16.

Stichopus fuscus, Théel, 1886a, p. 5. Non *S. fuscus* Ludwig.

Diagnosis: Large form (50 cm.). Spicules, an external layer of large tables which decrease in size and complexity as the animal grows older, and an inner layer of large, smooth buttons with six to ten holes. Feet with endplate and large perforated plates; papillae with curved rods.

Type: Lost.

Type Locality: Tomales Bay, California.

General Range: From British Columbia to Cedros Island, west of Lower California. From tide-pools (northern localities) to about 50 to 100 fathoms (southern localities).

Local Distribution: Three specimens were taken east of Cedros Island (Station 126: D-1 and D-6) between 38 and 45 fathoms on muddy bottoms.

Remarks: The most southern locality hitherto known was off Santa Barbara, California. The *Zaca* specimens exhibit the typical reduction of the tables which is so characteristic of this species. The study of a large number of individuals shows that Clark was right in his assumption that *S. johnsoni* Théel from off Santa Barbara, 22 fathoms, is an immature stage of *S. californicus* (as is also Théel's "*S. fuscus*" from the same region).

The species is easily distinguished from *S. parvimensis* Clark, which occurs in the same region, from southern California to Point San Bartholomé, Lower California, but apparently only in shallow water. The latter seems always to have almost black tips on the papillae and its tables are much smaller (diameter of disk 0.04-0.05 mm., contrasted with 0.06-0.10 mm. in *S. californicus*).

Genus *Stichopus* Brandt, 1835.

***Stichopus fuscus* Ludwig.**

Stichopus fuscus Ludwig, 1875, p. 22; 1898, p. 5, pl. 1, figs. 1-5; Clark, 1922, p. 45, (among non-identifiable forms).

Stichopus badionotus, Selenka, 1867, p. 316 (*partim*); Clark, 1922, p. 55, pl. 2, figs. 11-18 (*partim*).

Non *Stichopus fuscus*, Théel, 1886a, p. 5 (= *P. californicus* Stimpson).

Diagnosis: Large flattened form with thickened flanks, mouth ventral, anus terminal. Dorsal side with a varying number of blunt warts, ventral side with numerous feet in more or less crowded bands. Spicules, numerous small tables with round disk with a large number of marginal holes and a regular spire with flattened top with numerous small teeth. A varying number of C-shaped bodies are usually present. Feet with endplate and perforated supporting plates.

Type: Hamburg Museum.

Type Locality: "Patagonia." (Probably wrong, or an individual which accidentally has strayed so far south).

General Range: Gulf of California and southward to Ecuador, possibly reaching Patagonia. Shallow water, often exposed at low tide, to about 20 fathoms, or more.

Local Distribution: One adult was taken in 1 fathom near the shore of Santa Inez Bay, Gulf of California.

Remarks: This species is closely related to *S. badionotus* Selenka, a species which occurs widespread in the West Indies and Bermuda; Selenka's specimen from Acapulco, Mexico, refers undoubtedly to this species. The Pacific species seems always to be evenly brown or faintly mottled, while the West Indian form shows a diversity of variation in color. Comparison of well preserved specimens from both areas may show other, more important differences. The spicules have been found to be slightly larger in the Pacific form, viz., disk of tables 0.04-0.05 and 0.05-0.06 mm., C-shaped bodies 0.06 and 0.07 mm. in respectively *S. badionotus* and *S. fuscus*, according to Ludwig and Clark, and random samples taken by myself. (The spicules are slightly smaller in the ventral integument than in the dorsal as Ludwig already realized).

The species was described in 1875, from "Patagonia." Théel mentioned the species briefly in 1886 and identified in the same year (1886a) a specimen from off southern California as *S. fuscus*. Re-examination showed it was a young individual of *P. californicus*. In 1898 Ludwig revised the description of *S. fuscus*, figured the spicules of the type and mentioned that he had received two more specimens, one from Mazatlan, Mexico, and one from Machalilla, Ecuador. This reference was overlooked by Clark in his revision of 1922 and *S. fuscus* was therefore unjustly rejected.

Family Holothuriidae.

Genus *Holothuria* Linnaeus, 1758.

***Holothuria difficilis* Semper.**

Holothuria difficilis Semper, 1867, p. 92, pl. 30, fig. 21; Panning, 1929, I, p. 136, text-fig. 20.

Holothuria frequentiamensis, Clark, 1902, p. 530; Panning, 1934, III, p. 73.

Diagnosis: Soft-skinned form with small, inconspicuous papillae on the dorsal side and numerous soft feet on the ventral side. Spicules, well-developed tables with eight to ten holes in the disk and regular spire with numerous small teeth; inner layer consists of oval, smooth buttons with mostly six holes. Feet with endplate and supporting plates.

Type: Possibly in Germany.

Type Locality: Samoa.

General Range: Widespread in the western tropical Pacific, common in Hawaii. The most eastern record hitherto was from Clipperton Island (*H. frequentiamensis* Clark). Never taken from the mainland of Mexico or of Central or South America. In tide-pools, often under rocks.

Local Distribution: Three specimens were taken in tide-pools on the shore of Sulphur Bay, Clarion Island.

Remarks: This species is closely related to *H. parvula* from the West Indies and, like the latter, it multiplies frequently through transversal fission. It differs, however, in that it reaches twice the size of *H. parvula* and is dark in color. Also the spicules present minor and apparently constant differences (see Deichmann, 1922, p. 206).

***Holothuria inhabilis* Selenka.**

Holothuria inhabilis Selenka, 1867, p. 333, pl. 19, figs. 73-74; Panning, 1934, III, p. 79, text-fig. 62.

Holothuria maculata, Ludwig, 1894, p. 1. Non *H. maculata*, Brandt (*H. arenicola* auctores).

Diagnosis: Large holothurian (up to 20 cm. or more) with small tentacles, about 20 in number; mouth ventral, anus terminal; dorsally papillae, ventrally small feet. Skin filled with an abundance of spicules, thin and tough in younger individuals, thicker in larger ones. Calcareous ring low; a single Polian vesicle and a single stonecanal embedded in the dorsal mesentery but with the head free to the right. Spicules, tables with smooth to knobbed edge, frequently reduced; spire low with numerous teeth. Buttons crowded, mostly regular with six to ten holes, and varying from strongly knobbed to almost smooth. Feet with small endplate and numerous supporting plates with a varying number of holes along the sides and in the ends. Dorsal papillae often with trace of endplate and mostly curved supporting rods.

Type: M. C. Z.

Type Locality: Hawaii.

General Range: Hawaii, Cocos Island, Lower California, and Clarion Island. At about 50 fathoms depth.

Local Distribution: Three specimens were taken from Arena Bank (Station 136: D-26) off Clarion Island (Station 163: D-4) and from Santa Inez Bay, between 45 and 50 fathoms; on sandy bottoms.

Remarks: The three specimens vary much in size and color, no one of them being satisfactory as the basis for a description. The dorsal warts are very differently pronounced; as to color, it varies through different shades of brown. The spicules agree well with those of the type and show similar changes; they are apt to be somewhat less knobbed in the older specimens, also the smaller buttons become gradually more dominating.

The type specimens were up to now the only specimens described but re-examination of Ludwig's specimens of supposedly *H. maculata* Brandt (now commonly accepted as *H. arenicola* Semper) from Cocos Island, 66 fathoms, (1894), showed that they are *H. inhabilis*. Ludwig had evidently been misled by some of the smoother buttons. His specimens of *H. maculata* from shallow water near Panama (1875) are correctly identified, as may be inferred from his description of the inner anatomy.

***Holothuria lubrica* Selenka.**

Holothuria lubrica Selenka, 1867, p. 329, pl. 18, fig. 59; Panning, 1934, II, p. 45, text-fig. 38.

Diagnosis: Soft-skinned form with large tentacles, dorsally small papillae, ventrally large soft feet. Spicules, scattered curved rods with spines; feet with large endplate and a few curved rods sometimes with marginal holes. Stonecanal with long, spirally furrowed head; sometimes more than one canal is present.

Type: Probably in Germany.

Type Locality: Acapulco, Mexico.

General Range: West coast of Central America and Mexico, Lower California. According to various authors also reported from the East Indies, but possibly a case of wrong identification as a number of related forms are known. (See Panning, p. 45). Shallow water, mostly hidden under rocks.

Local Distribution: Four specimens were taken in tide-pools on Little Inez Island, Santa Inez Bay, Gulf of California.

Remarks: The color is dull slate-gray with black tentacles and often two rows of black spots on the dorsal side; the ventral feet have yellow tips.

Like the related form *H. glaberrima*, from the West Indies, this species seems eminently fitted to withstand the effect of the surf. It clings tenaciously to rocks and is very difficult to wrench off without damaging the tube-feet.

***Holothuria paraprinceps* sp. nov.**

(Text-figure 1, 1-10).

Diagnosis: Stout form (probably up to 25 cm. or more) with ventral mouth and terminal anus. Dorsal side with small conical papilla; ventral side with comparatively small feet often completely retracted. Skin rigid with spicules, probably relatively thin but tough in the expanded specimen. Calcareous ring tall, with distinct, low, blunt, posterior projections on the radials. Spicules small; tables (disk 0.04-0.08 mm.) with knobbed edge (knobs often bent upward) and frequently spire reduced to four knobs. In the papillae a number of huge tables (height 0.3 mm.) with pointed conical spire. Numerous buttons (0.05-0.09 mm. long), often incomplete, mostly with six holes and varying from almost smooth to knobbed. Ventral feet with small endplate and numerous large, smooth supporting rods or plates with perforations along the sides and in the ends. Dorsal papillae with no endplate or a vestige and curved rods. Color almost black with a whitish ring around the base of the papillae.

Type: Cat. No. 1807 (M. C. Z.).

Type Locality: Arena Bank, Gulf of California, 35 fathoms.

General Range: Known from the type locality and also off Panama (mentioned by Deichmann, 1930, p. 59, without name attached). From 35 fathoms.

Local Distribution: One specimen, the holotype, was taken on Arena Bank (Station 136: D-30) at a depth of 35 fathoms on a sandy bottom.

Remarks: The specimen examined must have measured 20 to 25 cm. in expanded condition. It was cut open and the inner organs removed so that very little can be said about its anatomy. Probably it resembles that of *H. princeps* Selenka. Aside from the difference in color, the spicules are much more smooth and regular in *H. paraprinceps* than in Selenka's species, although most likely they have developed from the same stock.

In the West Pacific there are two other species in which large, tack-like tables have been described. One is *H. spinifera* Théel (1886, p. 176, pl. 8, fig. 1) from the Philippines, 18 fathoms; also Ceylon, Pearson, 1913; (see Panning). It differs from *H. paraprinceps* in the lighter color and in its lack of posterior prolongations on the calcareous ring (possibly merely that Théel did not consider the protuberances worthy of that name). Direct comparison of the spicules is necessary in order to decide whether the two species are identical. The other form is *H. fusco-olivacea* Fisher (1907, p. 672, pl. 89, figs. 3, 3a, pl. 70, fig. 3). Its tack-like tables are much smaller (0.12 mm.) and besides it has some peculiar, spiny, warted buttons, which are entirely unlike those found in *H. paraprinceps*.

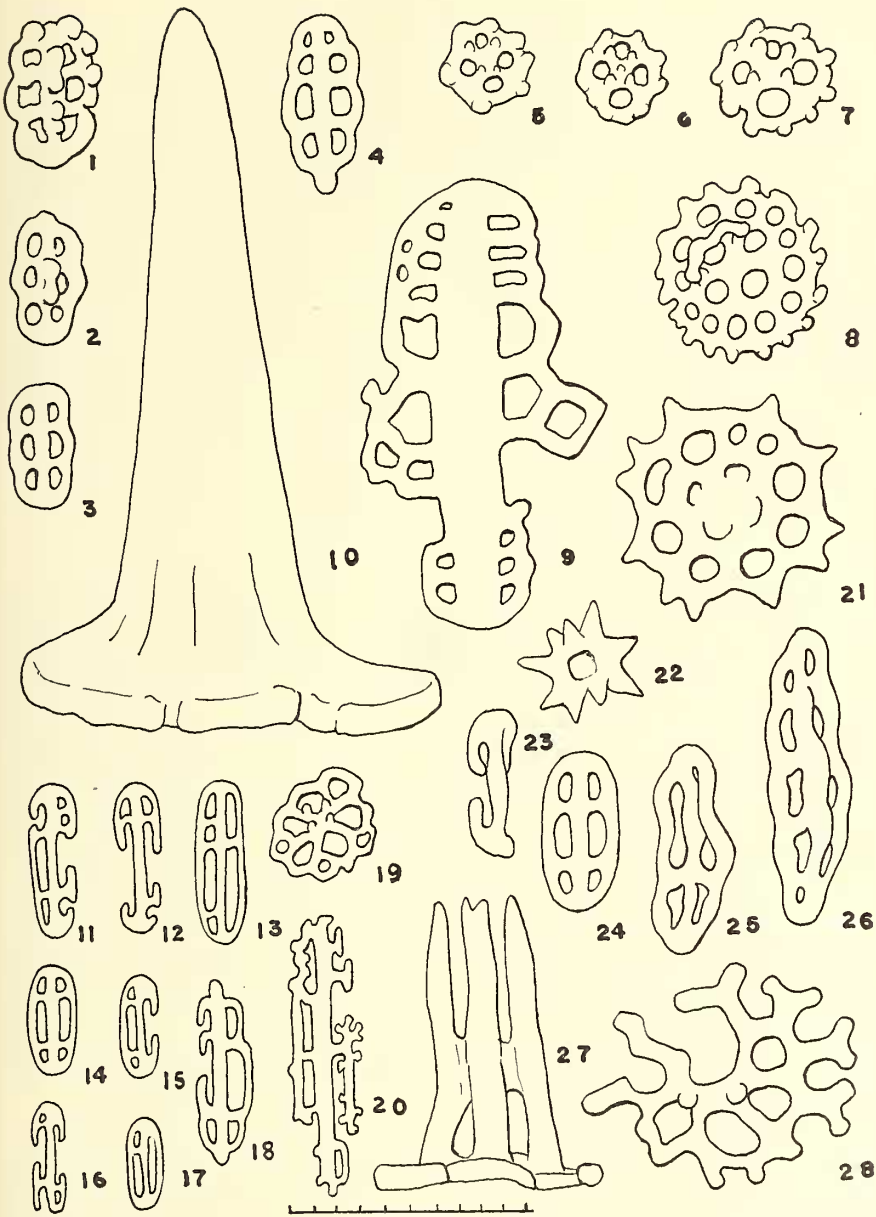
***Holothuria pluricuriosa* sp. nov.**

(Text-figure 1, 11-20).

Diagnosis: Stout form with blunt ends, mouth terminal, anus terminal, skin smooth, slippery; dorsally numerous papillae, many on low warts; ventrally numerous papilliform feet, completely retractile. Calcareous ring of typical shape, one ventral Polian vesicle and a tuft of free stonecanals on the right side of the dorsal mesenterium. Spicules, small tables with smooth disk (0.05 mm.) and low spire, often reduced; numerous smooth oblong buttons (0.04-0.015 mm.) with narrow, slit-like holes, mostly two to six in number, often twisted or incomplete. No endplate seems to be present in the ventral feet; a few straight or curved rods or plates resembling irregular buttons are found in both the dorsal and ventral appendages.

Type: Cat. No. 1808 (M. C. Z.).

Type Locality: Santa Inez Bay, Gulf of California.



Text-figure 1.

Scale 1/100 mm.

Holothuria paraprinceps sp. nov. 1-4, various types of buttons; 5-8, various tables; 9, supporting plate from tube-foot; 10, large table from papilla.

Holothuria pluricuriosa sp. nov. 11-18, buttons; 19 table; 20, supporting plate from tube-foot.

Holothuria zaca sp. nov. 21, table; 22, tip of spire from same; 23-26, buttons; 27, large table from papilla; 28, incomplete disk of table.

General Range: Known only from the type locality, at few fathoms' depth, possibly also between tide marks.

Local Distribution: A single specimen, the holotype, was taken in Santa Inez Bay (Station 141: D-1) between 7 and 9 fathoms, on a bottom composed of sand and finely crushed shell.

Remarks: The specimen is strongly contracted and measures only 7 cm.; expanded it would probably be twice as long. Color in life plain light brown.

The species seems superficially most closely related to *H. curiosa* Ludwig from the East Indies, but differs in its color and the presence of numerous stonecanals. The relationship of all the forms with reduced tables and incomplete twisted buttons needs, however, re-investigation. Panning has placed *H. fuscobrunnea* Théel as a variety of *H. curiosa* and as the former is reported from both the Hawaiian Islands and the Galápagos Islands (Clark, 1902, p. 527), it might be thought that the present species is *H. fuscobrunnea*. Comparison of Clark's specimen shows pronounced differences in the spicules, viz., spinous rim on the tables, shorter, more regular buttons and huge, bilaterally symmetrical plates in the ventral feet which, moreover, have large endplates. If Panning's assumption is correct, that *H. curiosa* is closely related to *H. fuscobrunnea*, then the present species is not particularly related to the former species.

***Holothuria zacae* sp. nov.**

(Text-figure 1, 21-28).

Diagnosis: Stout, smooth-skinned form with about 20 small tentacles; dorsal and ventral side with numerous retractile papillae, on the ventrum often completely retracted into pits. Spicules, scattered tables of two types, viz., smaller with regular disk (0.08-0.09 mm.) with pointed marginal teeth and tapering spire ending in few pointed teeth, and larger tables with irregular disk, often incomplete, and tall spire (0.12 mm.) composed of often more than four pillars which end as blunt or pointed rods. Buttons (0.08-0.09 mm.) thinly scattered, smooth, often twisted or incomplete, mostly with six holes. Apparently no endplate; appendages supported by larger buttons and curved rods with a varying number of holes along the sides and in the ends. Color, mottled with dark appendages and two rows of dark spots on the dorsal side.

Description: The type, which is strongly retracted, measures about 18 cm. The small tentacles are completely retracted, hidden by the strong, oral sphincter; only 19 were counted. It was not possible to decide the exact position of the mouth; the anus was terminal. The color is very striking: Dorsally two rows of large, irregular, dark spots; the individual appendages dorsal and ventral, are dark brown, surrounded by a pale ring at the base and the remaining part of the skin between them is light brown, on the ventrum almost white. The calcareous ring is low; all other organs were removed, so nothing can be said about the inner anatomy.

Type: Cat. No. 1809 (M. C. Z.).

Type Locality: Santa Inez Bay, Gulf of California.

General Range: Known only from the type locality. From 60 fathoms.

Local Distribution: A single specimen, the holotype, was taken from Santa Inez Bay (Station 147: D-2), from a depth of 60 fathoms on a muddy bottom.

Remarks: It is remarkable that so large and strikingly colored a species apparently has never been described before. There is, of course, the possibility that it has been disguised under another name and an insufficient description. No species which resembles it is known from the West Indies, and from Hawaii the only form which has somewhat similar spicules is *H. hawaiiensis* Fisher, and that species has 30 tentacles and also distinct endplates in the feet.

ORDER DENDROCHIROTA.

Family Cucumariidae.

Genus *Cucumaria* Blainville, 1834.***Cucumaria piperata* (Stimpson).***Pentacta piperata* Stimpson, 1864, p. 161.*Cucumaria piperata*, Clark, 1924, p. 56.

Diagnosis: Smooth-skinned form with large soft feet restricted to the ambulacra. Tentacles of equal size. Calcareous ring low. Spicules, knobbed, perforated plates with dentate handle and small, four-holed, swollen or knobbed buttons; in feet a rudimentary endplate and three-armed supporting rods. Spicules reduced in older individuals. Color white with minute brown spots.

Type: Lost.*Type Locality*: Puget Sound, Washington.

General Range: From Puget Sound as far south as Lower California. In the northern localities, in tidepools or at a few fathoms; farther south in deeper water, 45 fathoms.

Local Distribution: One small specimen was taken off San José Point, west of Lower California (Station 175: D-1) at a depth of 45 fathoms on a shaley bottom.

Remarks: Pacific Grove, California, has hitherto been regarded as the most southern locality where this species occurred, so the finding of it farther south is of interest. The pepper-like spots have disappeared in the present specimen, probably due to the effect of the formalin in which the animal was preserved; a note in the jar, however, indicates that the animal was spotted.

Cucumaria lissoplaca* Clark.Cucumaria lissoplaca* Clark, 1924, p. 55.

Diagnosis: Small form (3 cm.) with cylindrical feet in double rows along the ambulacra. Calcareous ring with long posterior prolongations. Spicules crowded, forming an external layer of minute, delicate tables which in most cases are destroyed, and an inner layer of smooth, perforated plates mostly lozenge-shaped with four central holes and a small hole in each end. Feet with endplate and curved supporting tables often with the two-pillared spire reduced.

Type: Victoria Memorial Museum, Ottawa, Canada.*Type Locality*: Queen Charlotte Sound, British Columbia.

General Range: South coast of Alaska (records unpublished) and as far south as Cedros Island, west of Lower California. Tidepools in the north to about 50 fathoms in the south.

Local Distribution: A single specimen was taken east of Cedros Island (Station 126: D-2) at a depth of 38 fathoms on a muddy bottom.

Remarks: Examination of a large number of specimens in various collections tends to show that this species has its main distribution from Alaska to Monterey Bay and the *Zaca* specimen represents the first record south of that region.

Normally this species is pure white, but the *Zaca* specimen is encrusted with a rusty brown sediment. No trace was found of the external, fragile tables, but since the specimen was preserved in formalin it was almost inevitable that they would be destroyed. These tables were not found in

the types, but in other (smaller) specimens, collected in the Puget Sound region and in Monterey Bay.

***Cucumaria populifera* (Stimpson).**

Pentacta populifera Stimpson, 1857, p. 161.

Cucumaria populifera, Clark, 1901, p. 171; 1924, p. 55; Bush, 1921, p. 76, text-figs. 40-41.

Cucumaria tenuicoriata, Wells, 1924, p. 121, pl. 3, fig. 4, text-fig. 4.

Diagnosis: Small form (5-6 cm.) usually fusiform body. Feet slender, restricted to the ambulacra forming narrow bands. Skin thin, flexible, filled with spicules. Calcareous ring with long posterior prolongations. Spicules, large tables with roundish to star-shaped disk with numerous holes and stout spire with numerous teeth; a varying number of smooth, perforated plates; feet with small endplate and numerous curved supporting tables with low two-pillared spire.

Type: Lost.

Type Locality: Puget Sound.

General Range: From Puget Sound to Cedros Island, west coast of Lower California. From a few to about 60 fathoms.

Local Distribution: A single specimen was taken east of Cedros Island (Station 126: D-9) at a depth of 56 fathoms on a muddy bottom.

Remarks: Hitherto the most southern locality for this species was Monterey Bay. Cedros Island represents probably the southern limit for this characteristic species. The *Zaca* specimen is one of the largest which has ever been taken.

Genus *Thyone* Oken, 1815.

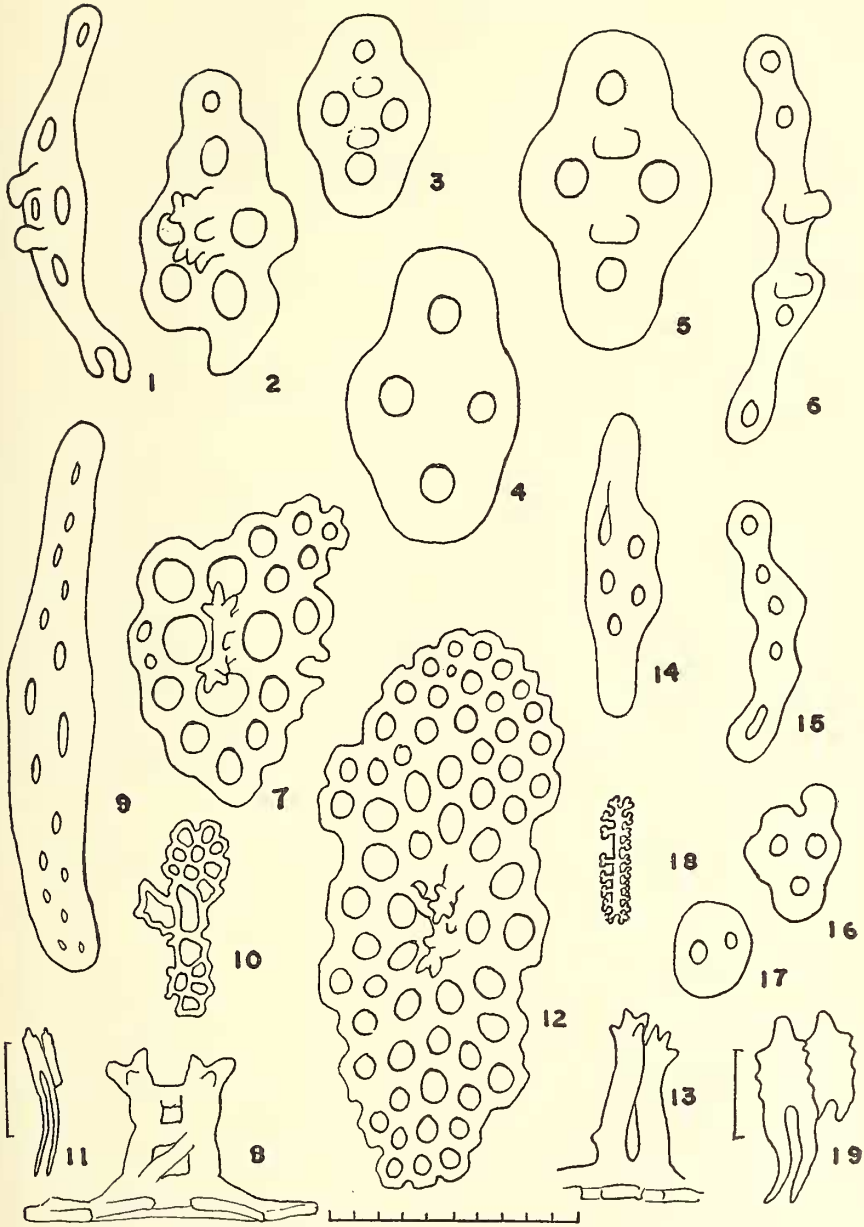
***Thyone bentii* sp. nov.**

(Text-figure 2, 1-11).

Diagnosis: Large form (11 cm.) with numerous, comparatively slender tube-feet scattered over the body, often indistinctly arranged in bands along the ambulacra. Tentacles surprisingly small, the two ventral ones smaller. Calcareous ring tall, narrow, with extremely long tails on the radials and narrow interradials. Spicules, four-holed oval tables with two-pillared spire; feet with curved supporting tables and endplate; introvert with two-pillared tables with numerous holes, tentacles with oblong, thick rods with few small holes and delicate, reticulated plates. Spicules apt to become reduced to buttons and rods.

Description: Externally the species resembles *T. briareus* Lesueur, but the feet are fewer. The color is pale brown, in the *Zaca* specimen small dots of pigment are scattered over the body. The type specimen measures about 5 cm. in length (strongly contorted, partly bloated), a specimen from off southern California measures about 7 cm., and the *Zaca* specimen, which lacks the oral end and most inner organs, is about 11 cm. long.

Internally the calcareous ring offers the most conspicuous feature. In the type it measures 1.5 cm. in height (including the tails), in the specimen from off southern California, 2 cm. The radials are deeply cleft and have very long narrow tails; the interradials are also narrow and tall. There is a single Polian vesicle, a single stonecanal attached in the dorsal mesentery; the third loop of the intestine is attached by a mesentery which runs in the ventral interambulacrum and, in its latter part, is attached to the midventral ambulacrum. The respiratory trees are (in the *Zaca* specimen) attached to the lateral interambulacra and each has a large, ventral branch; the



Text-figure 2.

Large magnification, scale 1/100 mm., except 11 and 19, scale 1 cm.

Thyone bentii sp. nov. 1-3, supporting table and reduced tables from the type; 4-6, reduced tables and supporting table from the *Zaca* specimen; 7-8, tables from introvert; 9-10, red and perforated plate from tentacles, all from type; 11, radial and interradial piece of calcareous ring, type.

Thyone glasselli Deichmann. 12-13, table from introvert; 14-17, supporting rods and buttons; 18, rosette from tentacle; 19, radial and interradial piece from calcareous ring, all from type.

gonads form in all specimens two tufts of numerous fine tubes attached in the dorsal mid-line, almost equidistant from oral and anal end, possibly closer to the anal end.

The spicules are not crowded and undergo considerable modifications; possibly they may disappear completely. Typically they consist of oval tables with four holes and two-pillared spire, and the supporting tables in the feet are derived from the same type which has become elongate and usually has a small perforation in each end. The endplate seems always to be well developed. In the type these spicules dominate, although reduced button-like tables and rod-like supporting plates may occur. In the *Zaca* specimen, however, most spicules have changed to the button and rod-like stage, and in the specimen from Southern California they are extremely reduced.

Type: Cat. No. 1810 (M. C. Z.).

Type Locality: Puget Sound (H. L. Clark coll.).

General Range: From Puget Sound, to west coast of Lower California; about 40-60 fathoms.

Local Distribution: A single specimen was taken east of Cedros Island (Station 127: D-1) by the *Zaca* at a depth of 38 fathoms on a muddy bottom. (M. C. Z., Cat. No. 1812). Only two other specimens are known, viz., the type from Puget Sound (M. C. Z.), and a specimen from off Southern California (U. S. N. M.).

Remarks: It lies near to question the affinities of the present species with *T. glasselli* Deichmann (Text-figure 2, 12-19) recently (1936, p. 63) described from the Gulf of California. Although the latter species undoubtedly has similar tables when it is young, it cannot possibly be confused with *T. benti* as comparison of the calcareous ring and the spicules in the introvert shows. It is, comparatively speaking, a much more robust form with a crown of large tentacles, with broad radials and interradials and relatively short tails on the calcareous ring. The introvert has much larger and more elaborate tables and the tentacles contain typical rosettes but not heavy, perforated rods, nor delicate reticulated plates.

Family Psolidae.

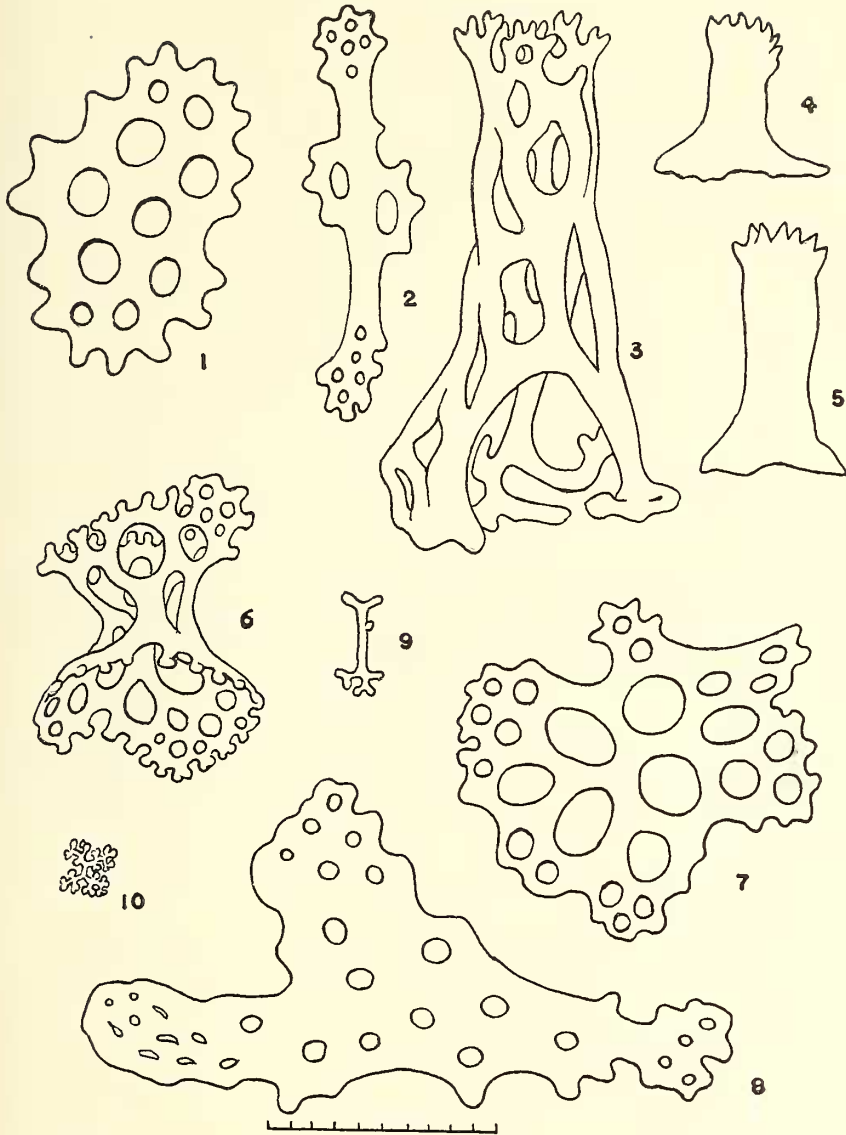
Genus *Thyonepsolus* Clark, 1901.

***Thyonepsolus beebei* sp. nov.**

(Text-figure 3, 1-10).

?*Thyonepsolus nutriens* Clark, 1923, p. 161. Non *T. nutriens* Clark, 1901.

Diagnosis: Small form (few cm.) with distinct sole with three crowded bands of feet; dorsal side with numerous feet and covered completely by comparatively large scales and with a well developed layer of external spicules. Spicules in sole perforated plates (0.14-0.17 mm.) with dentate edge; feet with large endplate and oblong, perforated supporting rods (0.14-0.18 mm.). Dorsal side with large, heavy scales and a layer of irregular perforated plates (0.17-0.30 mm.) slightly hollow, smooth, often with four large central holes and a number of smaller holes in the margin; plates sometimes cross or star-shaped. Besides, a large number of tall, tower-like deposits (0.25-0.30 mm.) with more or less flaring edge and a spire composed of coalescent stems ending in more or less distinct teeth, and small (0.1 mm.), delicate, hourglass-shaped bodies with lace-like perforations; feet with small but distinct endplate and oblong, perforated rods. Tentacles with heavy, thick plates and rods with few, small holes; branches with minute rods and rosettes.



Text-figure 3.

Large magnification except 4-5; scales 1/100 mm. and 1/10 mm.

Thyonepsolus beebeyi sp. nov. 1, plate from sole; 2, supporting rod from ventral tube foot; 3, young tower from dorsal side; 4-5, outline of complete towers (low magnification); 6, hourglass-shaped body; 7, perforated plate from dorsal side; 8, plate from tentacles; 9-10, rod and rosette from tentacle.

Type: Cat. No. 1811 (M. C. Z.).

Type Locality: Off Arena Bank, Gulf of California.

General Range: At present known only from the type locality but very likely Clark's record of *T. nutriens* from "Lower California" refers to this

species. Likewise Verrill's imperfectly described *Lissothuria ornata* (1867) from Panama may quite well be this species. From shallow water (2.5 fathoms).

Local Distribution: A single specimen, the holotype, was taken off Arena Bank (Station 136: D-33) at a depth of 2.5 fathoms in coral (*Pocillopora ligulata*).

Remarks: Superficially this species resembles *T. nutriens* Clark from the coast of California, and has the same red color. Actually it is more closely related to *T. brasiliensis* (Théel) from the West Indies. Unfortunately neither the material of *T. brasiliensis* (Théel's two types and a number of young individuals from Tobago), nor the single specimen of *T. beebei* (originally preserved in formalin) are well suited for comparison, and the apparent external dissimilarities between the two forms are probably purely accidental. An analysis of the spicules shows that *T. beebei* has more distinct marginal teeth on the plates in the sole, the dorsal plates are larger and more reticulated, the tower-like deposits have frequently a broad base and the hourglass-shaped bodies are more complete with numerous perforations, than is the case in *T. brasiliensis* (see Deichmann, 1930, pl. 21, figs. 1-6). The spicules in the tentacles are of exactly the same size and type in both forms.

The chief differences between the three species are briefly summarized as follows:

1. Dorsal scalecovering incomplete in the midline (in adult specimens). Scales numerous and small; external layer of perforated plates crowded. Tentacles lacking rosettes and delicate rods but with numerous four-holed buttons.

T. nutriens Clark
(Coast of California).

1. Dorsal scalecovering complete in the midline; scales few (7-10) between oral and anal scales, and large. Tentacles with rosettes and delicate rods. 2.
2. Plates in sole with almost smooth margin; dorsal plates mostly small, incomplete, with few holes; tower-like bodies with small base.

T. brasiliensis (Théel)
(West Indies).

2. Plates in sole with strongly indented margin; dorsal plates large with numerous holes; tower-like bodies with broad base.

T. beebei sp. nov.
(Gulf of California).

ORDER MOLPADONIA.

Family Molpadiidae.

Genus *Molpadia* Cuvier, 1817.

***Molpadia intermedia* (Ludwig).**

Trochostoma intermedia Ludwig, 1894, p. 161, pl. 16, figs. 7-21.

Molpadia intermedia, Clark, 1908, p. 162, pl. 12, figs. 5-15.

Diagnosis: *Molpadia* with small tables with three-pillared spire; same type in tail region but with two marginal prolongations from the disk. Anchors and raquet-shaped bodies present in young individuals. Spicules almost completely reduced in adult, except in tail region. Numerous phosphatic bodies.

Type: U. S. N. M.

Type Locality: Off Central America.

General Range: From Alaska to off the west coast of South America. From about 30 to 200 fathoms. (Records from deeper water possibly indicate another species).

Local Distribution: Three specimens were taken east of Cedros Island (Station 126: D-5) at a depth of 43 fathoms on a muddy bottom.

Remarks: One of the most common species off the west coast of North and South America in muddy localities.

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